Columbia and Lower Willamette River Project
Lower Willamette River, Portland Harbor
Sediment Evaluation
November 1997 6

ABSTRACT

This report details sediment quality investigations conducted in Portland Harbor, Lower Willamette River, on 13 and 14 November, 1996. Sediment from a recurring shoal between River Mile (RM) 8.3 and 10.1 on the southwest side of the river was evaluated for acceptability for both upland and in-water disposal according to provisions of the Clean Water Act. The sediment tested is predominantly silt, but contains some clay and a small amount of sand. Samples were analyzed for total metals, pesticides, PCBs, PAHs, phenols, and organotins and were found to be below concern levels. No unacceptable adverse environmental impacts are expected from either upland or unconfined in-water disposal.

INTRODUCTION

PREVIOUS STUDIES

1. The Columbia and Lower Willamette (C&LW) Federal project is a deep-draft channel that is authorized to a depth of 40 feet, but the entire channel is not maintained at forty feet. The project extends from the mouth of the Willamette to the Broadway Bridge located at approximate RM 11.7. The project channel is between 600 and 1900 feet wide. Between 1986 and 1990 about 800,000 cubic yards were dredged by clamshell from the channel. The sediment has historically been disposed in-water at the Morgan Bar dispersive site at River Mile (RM) 100 on the Columbia River. Some material has gone to a confined in-water site at Ross Island lagoon. In 1989 about 10,000 cubic yards went upland on Port of Portland property.

2. Sediment evaluations of shoals in the channel were conducted in 1988, 1989 and 1992 . The 1988 study was an extensive survey in which 22 samples were collected. Both Tier II and Tier III chemical and biological tests were performed on the sediment. Most of the sediment, including that between RM 8.0 and 10.1, was found acceptable for unconfined in-water disposal.

3. The 1992 study evaluated shoal material at five locations between RM 8.0 and 10.3 in the Lower Willamette River within the Portland Harbor. The results revealed that except for zinc, metals, TOC, and oil and grease were low and typical of uncontaminated river sediment. Zinc concentration in one sample was found to exceed EPA Region 10 screening levels, but was below Portland District's concern level. Organics, including pesticides, PCB's, PAH's, phenols and acid-volatile sulfides were above detection levels, but below concern levels in several samples. In one of the six samples PAH's were above concern levels. Sediment analyzed from the shoal between RM 8 and 10.2 was considered acceptable for upland or unconfined in-water disposal. Sediment sampled from RM 10.3 contained contaminants to a degree that precluded its being dredged at that time.

CURRENT STUDY

4. The purpose of the current study was to evaluate shoal material in the Lower Willamette River between RM 8.3 and 10.1 on the southwest side of the river to assure compliance with requirements of the Clean Water Act (CWA) and to determine acceptable disposal options. Only large shoals that had developed since the 1992 dredging operations were sampled and analyzed for contaminants. The areas dredged in the lower Willamette River is routinely tested for contaminants of concern on a 5 year schedule. A recent depth survey of the channel indicated that a long shoal had formed on the left side of the channel (facing downstream) between RM 8.0 and 10.4. The material to be dredged from the central segment of this shoal is the subject of this sediment evaluation. Historically, the shoals in this reach have been composed of sediment that is greater than 20 % silt and clay and 5 % volatile solids. Clays and silts that have elevated levels of volatile solids, (organic sediment) can serve as a sink for contaminants and are therefore subjected to chemical as well as physical analyses.

METHODS

SEDIMENT SAMPLING

5. Six sediment samples were taken by the firm of Hart-Crowser on 13 and 14 November 1996. Four samples were taken using a Benthos gravity corer, but two had to be taken using a Ponar grab sampler because very soft material which could not be retrieved by a coring device was encountered at two locations. The sample locations are shown on the enclosed map (Figure 1). Cores from the Benthos sampler were extruded on the same day as collection, the length of each core was measured and any obvious layers were described. The core lengths were considered to be representative of the project dredge prism. A lengthwise section of each core was composited and subjected to physical and chemical analyses. The physical samples were each placed in a plastic ziplock bag and cold stored during transport to the laboratory. Physical analyses consisted of determining volatile solids content, grain size distribution, resuspended density, void ratio, specific gravity and particle shape. Samples taken for chemical analysis were placed in acid washed and hexane rinsed glass jars topped with teflon lined lids and placed in a ziplock bag. They were cold stored from time of collection until analysis at the contract analytical lab, Columbia Analytical Services. Sediments were analyzed for the following chemicals: phenolics, acid volatile sulfides (AVS), total organic carbon (TOC), total metals, organochlorine pesticides, polychlorinated biphenyls (PCBs), organotins and polynuclear aromatic hydrocarbons (PAHs). All sampling procedures and tests were conducted according to EPA and Corps approved methods. A quality assurance report of contract lab performance was prepared by the U. S. Army Corps of Engineers Materials Lab, Troutdale, Oregon, which along with the raw data, is on file at the Portland District

RESULTS/DISCUSSION

PHYSICAL ANALYSIS

6. Results of physical analyses are shown in Table 1. The mean grain sizes varied from medium silt to medium sand. As expected, all the samples contained more than 20 % silt and 5 % volatile solids. The silt content averaged 52 % for all samples. The mean clay content was 11.2 % and mean volatile solids was 6.1 %. Values for these physical properties are slightly lower than the values yielded from samples taken during previous studies, but with silt and volatile solids at these levels, there remains a potential for sediments in this reach of Portland Harbor to partition contaminants from the water column.

CHEMICAL ANALYSIS

7. Selected parameters, including total organic carbon (TOC) and acid volatile sulfides (AVS) were analyzed and results are shown in Tables 1 and 2, respectively. Sediments were also analyzed for Phenolics, but these were not detected in any of the samples. The average TOC for the sampled reach was 1.7 %. The mean value for AVS in the six samples was 3.5 ppm, which is slightly less than the value of 4.9 ppm AVS found in 1992.

METALS

8. Results of chemical analyses for metals are shown in Table 2. Of the metal concentrations reported only chromium was above Portland District established levels of concern. However, the mean chromium value was 24.7 ppm, which is only slightly above the 20.0 ppm threshold concern level. For comparison the concentrations of metals in 5 samples, taken in 1992 from the same areas, are also shown in Table 2. As can be seen, metals concentrations have changed little over the past 4 years except for zinc concentrations, which have decreased substantially.

ORGANICS

9. Total organic carbon level averaged 1.7 percent among the six samples, with WR-VC-5 having the highest level at 2.39 percent. These are low values since sediments considered "organic" have TOC levels of about 6 percent or more.

PESTICIDES/PCBs

10. Pesticides and PCB's concentrations are shown in Table 3. For comparison the only analytes shown here are those that were listed in the summary report in 1992. Very low levels of the pesticides DDE, DDD and DDT were detected in each of the samples. The amounts detected were estimates as they were very near the method detection limits. All six samples were estimated

to contain between 0.8 and 2 ppb of DDE, between 0.4 and 1 ppb of DDD and between 0.2 and 0.6 ppb DDT. Sample WR-VC-5 contained an estimated 0.8 ppb Endosulfan sulfate. These concentrations are well below levels of concern for pesticides. Each of the samples contained the PCB, Aroclor 1260 at estimated concentrations that ranged from the detection limit, 3 ppb in WR-VC-2, up to 10 ppb in WR-VC-4. These values are far below the level of concern for PCB's, which is the same as the 1992 testing revealed.

PAHs

11. All six samples contained small amounts of both low and high molecular weight PAH's. Table 4 shows values for selected PAH's obtained during this study and compares mean values obtained in 1992. With the exception WR-GC-1, which was taken from a shoal on the right side of the river, 1992 samples are not from coincident locations, but are representative of PAH levels in the same shoal. Two samples, WR-VC-3 and -5 contained each of the 18 analytes for which analysis is made in sediments. The lowest total PAH level was 149 ppb in WR-VC-2, while the highest level of total PAH's was 563 ppb found in WR-VC-5. The level of concern is 1,500 to 2,000 ppb total PAH, but highest level for total PAH's reported from this study was far below.

ORGANOTINS

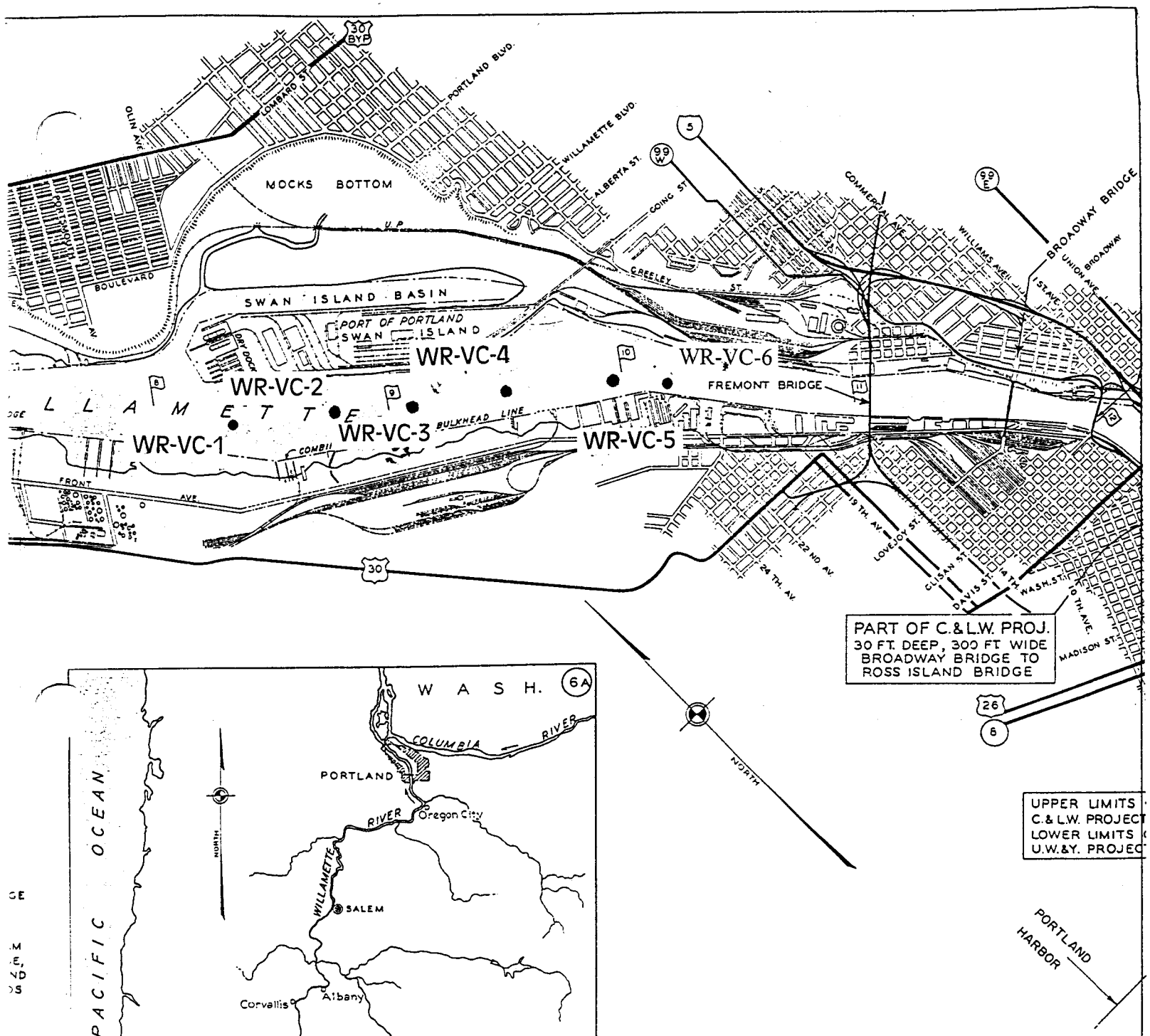
12. A mean value of 6.6 ppb for the specific organotin, Tributyltin (TBT) was found for all six samples. Samples WR-VC-3 and WR-VC-4 at 3 and 2 ppb, respectively, are above the reporting level of 1ppb TBT, but these results are attributed to laboratory contamination. The highest values found were 10 ppb in WR-VC-1 and 12 ppb in WR-VC-6, which values are less than 50 percent of the screening level of 73 ppb TBT. Dibutyltin ranged between 0.8 ppb and 2 ppb in samples WR-VC-1 through WR-VC-5, but the analyses were subject to laboratory interference, therefore these results are estimated values.

QUALITY CONTROL

13. A quality assurance report was prepared by the Portland District Materials Lab, Troutdale, Oregon. All holding times met requirements. Spike data for lead was outside control limits and lead values reported should be considered high estimates. Values for mercury in all six samples should be considered estimates. The values reported for Anthracene in all six samples, Tributyltin in WR-VC- 3 and WR-VC-4, and Dibutyltin in samples WR-VC-1 through -5 should be considered estimated values and are attributed to laboratory contamination. There were some matrix interferences, but generally, detection limits, surrogate recoveries, matrix spike and matrix spike duplicates were acceptable. Even though some method blanks showed targeted analytes, or were out of quality or precision limits, most of these results of contaminant analyses were considered acceptable based on quality control data.

RECOMMENDATIONS

Hart - Crowser, contractor for The Port of Portland, collected sediment samples from the shoal in the Federal project and along the port docks on the southwest side (left side facing downstream) of the Willamette River between RM 8.3 and 10.1. Six sediment samples from the zone to be dredged were collected for the Corps, and were subjected to chemical and physical analysis. The concentrations of contaminants in all six sediments analyzed were below established concern levels, and were therefore found to be acceptable for both unconfined in-water or upland disposal according to provisions of the Clean Water Act (Section 404 (b) (1) Guidelines). In 1988 the Corps performed elutriate tests on sediments containing chemically similar contaminants from the same locations and found levels of metals in the water column that were below EPA freshwater, acute water quality criteria. Chemical analyses on sediments obtained from the same locations in 1992 also showed contaminants to be below screening levels, with concentrations of some contaminants exhibiting a slight decrease. Further decreases in specific contaminants were noted in the analyses reported here, although no trends were yet apparent. Based on these analytical results, no unacceptable adverse environmental impacts would be expected to result from unconfined in-water disposal in the Columbia River at the Morgan Bar disposal site..



VICINITY MAP

SCALE IN MILES

10 0 10 20

WILLAMETTE RIVER
PORTLAND, OREGON, HARBOR

SCALE IN FEET

1000 0 1000 2000 3000

U.S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

REVISED DEC. 1977

Figure 1

Table 1. Results of Physical Analysis of Portland Harbor Sediment Samples, November 1996.

Sample	resuspend density gm/l	specific gravity	mean grain size mm	sand %	silt %	clay %	volatile solids %
WR-VC-1	1438	2.679	0.052	41.6	24.6	19.5	5.4
WR-VC-2	1528	2.685	0.040	45.7	29.3	25.0	5.0
WR-VC-3	1444	2.673	0.022	22,2	46.2	31.6	6.0
WR-VC-4	1500	2.337	0.075	50.1	26.6	23.3	6.3
WR-VC-5	1323	2.628	0.022	18.5	53.2	28.3	7.7
WR-VC-6	1358	2.636	0.030	31.4	42.7	25.5	6.4
mean	1432	2.606	0.040	34.9	37.1	25.5	6.1
92 mean	na	na	0.040	33.2	58.0	8.8	6.9

Table 3. Pesticides and PCB's, Portland Harbor Sediment Samples, November, 1996

sample	Delta-BHC	4,4` DDE	Endosulfan II	4,4'DDD	4,4`DDT	PCB's
			ppb			
WR-VC-1	ND	1	ND	1	0.4	4
WR-VC-2	ND	0.8	ND	0.4	0.2	3
WR-VC-3	ND	2	ND	1	0.5	4
WR-VC-4	ND	1	ND	1	0.6	10
WR-VC-5	ND	2	ND	1	0.5	8
WR-VC-6	ND	2	ND	1	0.6	8
mean '96	ND	1.5	ND	0.9	0.5	6.2
mean '92	3.2	2.5	2	2.5	ND	10

Note: The 1992 results were reported in mixed, absolute and approximate values.

Table 4. Concentrations (ppb) of Selected PAHs and Phenols in Portland Harbor Sediment Samples, November, 1996

sample	total phe-nol	naptha-lene	phenan thene	fluoran threne	pyrene	benzo(a) anthracene	chrysen e	benzo-(bk) fluor anthene	benzo (a) pyrene	PAH total 1996	PAH total 1992
WR-VC-1-	ND	4	25	53	53	20	26	39	14	287	-
WR-VC-2	ND	4	12	24	25	11	18	26	5	149	-
WR-VC-3	ND	7	16	28	16	27	27	38	6	222	-
WR-VC-4	ND	25	52	61	59	18	38	28	ND	414	-
WR-VC-5	ND	16	60	86	79	32	57	83	8	563	-
WR-VC-6	ND	12	47	64	61	23	56	69	ND	440	-
MEAN	ND	11.3	35.5	52.7	48.8	21.8	37	47.2	5.5	345.8	-
1992 MEAN	80	ND	86	122	129.4	ND	70	ND	ND	-	312

Table 2. Total Metals and Acid Volatile Sulfides, Portland Harbor Sediment Samples, November, 1996.

ppm

Sample	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	AVS
WR-VC-1	2.2	0.12	23.2	25.7	10.3	0.06	21.5	0.14	61.8	3.1
WR-VC-2	2.1	0.12	20.4	26.2	10.1	0.07	19.5	0.13	59.0	3.2
WR-VC-3	3.0	0.15	26.6	35.6	12.7	0.06	23.3	0.18	67.4	6.5
WR-VC-4	2.3	0.13	23.9	29.1	12.7	0.06	22.7	0.16	66.8	2.7
WR-VC-5	3.1	0.18	29.1	38.5	14.9	0.08	24.4	0.26	78.1	3.0
WR-VC-6	4.8	0.15	24.9	46.0	17.4	0.07	22.1	0.29	90.1	2.9
mean '96	2.9	0.14	24.7	33.5	13.0	0.04	22.2	0.19	70.5	3.6
mean '92	3.0	0.24	31.0	39.8	15,2	0.11	23.7	-----	114.7	4.9